Review Article

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The benefits of physical exercise in the rehabilitation process of Guillain-Barré syndrome: a systematic review

Os benefícios do exercício físico no processo de reabilitação da Síndrome de Guillain-Barré: uma revisão sistemática

Bárbara Gabriela de Carvalho Castro[1], Patrícia Belém Melo[1], Giandra Anceski Bataglion[1], Keegan Bezerra Ponce[2], Kathya Augusta Thomé Lopes[1], Minerva Leopoldina de Castro Amorim[1]

ABSTRACT

Guillain-Barré Syndrome (GBS) affects peripheral nerves and is characterized by the loss of strength in the lower limbs and decreased tendon reflexes due to its autoimmune and inflammatory nature. This disease affects the myelin sheath of the proximal portion, causing a progressive and rapidly evolving polyneuropathy leading to death due to respiratory failure. **Objective:** Identify and demonstrate the benefits of physical exercise in the Rehabilitation Process for individuals diagnosed with GBS. **Methods:** This systematic review was conducted at the CAPES (Brazilian Agency for Support and Evaluation of Graduate Education), LILACS, PubMed, SciELO, Google Scholar, and Virtual Health Library (VHL) databases. Studies published from 2010 to 2022. The studies were identified and selected according to PRISMA guidelines, enabling consistent analysis and increased validity and reliability of the studies included in this review. **Results:** Eight studies were included in the systematic review. In general, the studies demonstrated that physical exercise benefits GBS rehabilitation. All included studies had positive results regarding physical exercise in the rehabilitation process. **Conclusion:** High-quality literature on this topic is scarce, therefore the readers must be cautious when reading the evidence presented in this review before concluding the benefits of physical exercise for patients with GBS, despite the statistically significant data on the improvement of mobility, range of motion (ROM), muscle strength, cardiopulmonary function, and on the fatigue reduction.

Keywords: Guillain-Barre Syndrome, Physical Exercise, Rehabilitation

RESUMO

A Síndrome de Guillain-Barré (SGB) atinge nervos periféricos, se caracterizando pela perda de força dos membros inferiores e diminuindo os reflexos tendinosos, por ser de caráter autoimune e inflamatória, afeta a bainha de mielina da porção proximal, sendo uma polineuropatia progressiva e de rápida evolução podendo levar o paciente a óbito por insuficiência respiratória. **Objetivo:** Revisar e sintetizar estudos sobre a prática do exercício físico em indivíduos diagnosticados com Síndrome de Guillain-Barré. **Método:** Trata-se de uma revisão sistemática onde a busca foi realizada nas bases de dados Portal de Periódicos da Capes, LILACS, PubMed, SciELO, Google Acadêmico e Biblioteca Virtual em Saúde (BVS). Considerando estudos publicados nos períodos de 2010 a 2022, que tem como objetivo identificar, selecionar, reunir, avaliar e sintetizar evidências científicas, possibilitando uma análise consistente e assim, aumentando a validade dos estudos e consequentemente fornecendo evidências válidas e confiáveis. **Resultados:** Oito estudos foram incluídos na revisão sistemática. No geral, a análise dos resultados/dados dos estudos demonstrou que o exercício físico é benéfico para reabilitação da SGB. Todos os estudos selecionados e revisados tiveram resultado positivo sobre o exercício físico no processo de reabilitação. **Conclusão:** Devido à escassez da literatura atual, de alta qualidade e de amostras maiores, não é possível tirar conclusões consistentes apesar dos resultados eficazes para a melhora de pacientes com SGB, evoluindo nos aspectos de mobilidade, amplitude de movimento (ADM), força muscular, função cardiopulmonar e na redução da fadiga.

Palavras-chaves: Síndrome de Guillain-Barré, Exercício Físico, Reabilitação

[1] Universidade Federal do Amazonas - UFAM
[2] Secretaria Municipal de Educação de Manaus/AM

Corresponding Author
Bárbara Gabriela de Carvalho Castro
E-mail: barbaracastro1011@gmail.com

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Nothing to declare

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INTRODUCTION

Guillain-Barré Syndrome (GBS), a peripheral nervous system disease, is characterized by the loss of strength in the lower limbs and decreased tendon reflexes. Autoimmune in nature, as the body's immune system fights parts of the nervous system, and also inflammatory, GBS depletes the proximal portion of the myelin sheath, causing a progressive and rapidly evolving polyneuropathy, which in turn may lead to death due to respiratory failure. The evolution of GBS is characterized by progressive motor loss, generally initiating at the lower limbs and progressing to the upper limbs, and by hyporeflexia or areflexia, implicating the cranial nerve.[1]

The disease has an average incidence of 1.3 cases per 100,000 inhabitants per year, affecting more men than women.[2] According to Atkinson et al.[3], although it can affect anyone regardless of age, sex, or ethnicity, it occurs mainly in people between 50 and 74. Its clinical course has three stages: progression, stabilization, and regression. Most cases begin occasionally, without seasonality, and its lethality rate stands between 5% and 15%.[4] Currently, infections such as Campylobacter, Zika Virus, dengue, Chikungunya, Cytomegalovirus, Epstein-Barr Virus, Measles, Influenza A Virus, Mycoplasma pneumoniae, Enterovirus D68, Hepatitis A, B, C, HIV, among others, have been associated to SGB. Orsini et al.[5] observe that some infectious conditions preceded the onset of GBS symptoms.

There are two main types of GBS: Acute Inflammatory Demyelinating Polyneuropathy (AIDP) and Acute Motor Axonal Neuropathy (AMAN), which is purely motor.[2] According to Fonseca et al.[6], patients with GBS may present static and dynamic balance deficits due to loss of motor function and muscle atrophy.

Dourado et al.[7] state that GBS has a plateau phase. In this phase, there are muscle strength fluctuations that may have different causes, and one of them is the autoantibodies persistence. The GBS diagnosis is clinical and laboratory, demanding Cerebrospinal Fluid (CSF) Analysis and electroneuromyography. Intravenous Human Immunoglobulin (IVIG) is a commonly used treatment in which antibodies are extracted from blood donors and injected into the vein of another person, in this case, an individual with GBS.

The objective of the intervention is to accelerate the patient's recovery. Some assessments may help the prognosis, such as the Functional Status Score for the Intensive Care Unit, the Medical Research Council (MRC) Scale for Muscle Strength, and the Functional Independence Measure (MIF). Each patient must be evaluated so that the proper treatment is provided, considering the specificities of each subject.[8]

There is evidence that physiotherapy is effective and essential in the early rehabilitation process of GBS, such that the earlier the treatment, the better the prognosis.[1] Khan et al.[9] emphasize that an interdisciplinary team must conduct rehabilitation to minimize the sequelae, and Fernandes[10] adds that the treatment aims to avoid deformations and gain muscle strength, range of motion (ROM), and independence to perform activities of daily living (ADLs).

A study by Freitas et al.[11] mentioned that patients with GBS endure negative impacts on their quality of life due to limitations and changes in personal satisfaction towards day-to-day life, as well as family and social life. It is known that physical activity, in general, has beneficial effects on health, delaying aging and preventing the development of chronic degenerative diseases.[12]

In this perspective, it is paramount to investigate the scientific literature regarding the rehabilitation processes for patients with GBS. Such scrutiny may enable and stimulate the scientific development of therapeutic guidelines for adequate physical exercise prescription.

OBJECTIVE

Identify and demonstrate the benefits of physical exercise in the Rehabilitation Process for individuals diagnosed with GBS.

METHOD

This study is a systematic review conducted according to the Reporting Items for Systematic Review and Meta-analyses: the PRISMA Statement guidelines.

Inclusion, exclusion, and eligibility criteria

Articles were eligible if they addressed the benefits of physical exercises, such as resistance training, flexibility, stretching, walking, aerobic conditioning, balance exercises, and multifunctional exercises delivered to patients diagnosed with GBS.

Documents published from 2010 to 2022 in Portuguese, English, or Spanish scientific journals that involved patients with GBS who joined a physical exercise program or were practitioners of physical exercise, with information regarding the benefits of physical exercise for this pathology and which presented a sufficient description of the exercise protocol were included in the review. Case studies and randomized clinical trials (RCTs) were also included.

Studies about the association of GBS with other syndromes and diseases, studies on GBS variants, invasive treatment methods such as surgery associated with similar techniques or methods, animal studies, dissertations or thesis, and any reviews were excluded.

Journal Databases

The searches were conducted in the following electronic journal databases and repositories: the Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES), LILACS, PubMed, SciELO, Google Scholar, and the Virtual Health Library (VHL). The references of the articles retrieved for analysis were also sources of possible articles for this review.

Search strategy

The search was structured by MeSH (Medical Subject Headings) keywords and words commonly found in the literature. The strategy considered the relevant elements of the research question, and the terms were combined using Boolean operators (AND, OR, or NOT), and truncation symbols were used to expand the search terms.

The search strategies followed the recommendations of the Methodological Guidelines, according to Brazilian recommendations for elaborating a systematic review and meta-analysis of randomized clinical trials.[13] The first descriptor was 'guillain-barré syndrome,' the second 'physical exercise' and 'physical rehabilitation,' and the third 'benefit.'

Data extraction process

The information extracted from the articles was (a) authors and year of publication; (b) study title/intervention (c) type of study; (d) country and setting of the study; (e) sample size; (f) age and sex of participants; (g) intervention strategies (physical activities prescribed, duration, and frequency); (h) outcomes and the benefit of physical exercise for patients with GBS.

Risk of bias statement

A potential risk of bias was present due to the inclusion criteria for participants in the studies included in this systematic review. In some studies, participants were recruited from a single hospital or clinic; in others, participants were recruited from a single clinic. These issues may limit the generalizability of the results given the non-representative samples found in the articles retrieved for analysis. The selected participants may differ from other populations in terms of socioeconomic aspects and access to healthcare. Therefore, it is essential to interpret the results cautiously, accounting for this possible limitation.

RESULTS

The databases and repositories searches listed 3,215 studies. However, the descriptors did not limit the search efficiently, returning other syndromes and diseases in the search results. After analyzing the titles, 148 studies were selected, and 22 duplicates were removed. During the abstract analysis, 120 studies were excluded. Two were included from the reference lists in the complete text analysis, and eight studies were included in the review. Figure 1 displays the article retrieval, selection, and inclusion procedure performed according to the PRISMA 2020 diagram.[14]

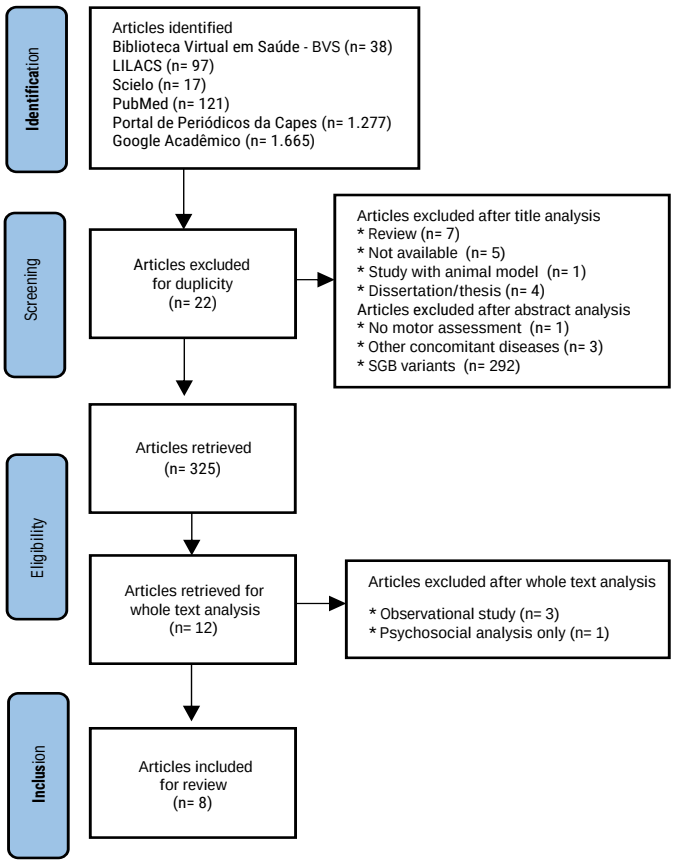

Figure 1. Flow diagram for study selection

We excluded 27 studies that involved the association of GBS with other syndromes and diseases and studies regarding GBS variants. Also, 35 other studies were excluded for not adequately describing the exercise protocol. Finally, 17 reviews, 29 studies published before 2010, and 12 dissertations/theses were excluded. The included studies were classified according to the Oxford Centre for Evidence-Based Medicine.[15] Three studies were case reports (level 4), three were case-control studies (level 3b), and two studies were randomized controlled trials (level 1b) (Chart 1).

Chart 1. Study identification and description

Author/Year	Level Evidence	Study objective
Sá et al.[8] (2015)	3b	Evaluate motor changes and describe the evolution of physical therapy in patients post Guillain-Barré syndrome (GBS) using techniques recommended by the Bobath and Proprioceptive Neuromuscular Facilitation (PNF) methods
Dayyer et al.[16] (2018)	3b	Determine the effect of eight-week selected exercises on strength, RoM, and QoL in patients suffering from GBS
Khan et al.[17] (2011)	1b	Evaluate the efficacy of a multidisciplinary outpatient rehabilitation program of high intensity compared to low intensity over 12 months for patients with chronic GBS
Ko et al.[18] (2017)	3b	Investigate the effects of daily living occupational therapy and resistance exercise on the performance of activities of daily living and muscular fitness in a patient with Guillain-Barré syndrome
Kou et al.[19] (2016)	4	Provide clinicians with a focused, easily implemented intervention, a comprehensive program of functionally based interventions for a patient with GBS pre-and postpartum to recover independence
Montini et al.[20] (2016)	4	Describe the evolution of a patient with GBS during the intensive, multidisciplinary inpatient rehabilitation program, discussing the therapeutic possibilities for rehabilitation of the disease
Nascimento et al.[21] (2012)	4	Compare and analyze the efficiency of a hydrotherapy protocol of pre and post-physiotherapeutic intervention on Guillain-Barré syndrome
Sendhilkumar et al.[22] (2013)	1b	Study the add-on effects of pranayama and meditation in the rehabilitation of patients with Guillain-Barré syndrome (GBS)

RoM= Range of Motion; QoL= Quality of life; GBS= Guillain-Barré syndrome; 3b= Case-control study; 1b= Randomized clinical trial; 4= Case report

The pool of participants for the included articles. The articles reported 108 participants, such that 17 were male, 12 were female, and the other 79 were not identified. The age of the participants ranged between 6 and 58 years; four patients were children, and one study reported including one pregnant woman. Patients

were generally hospitalized during participation or had been hospitalized for pharmacological intervention (Chart 2).

The main difficulties these patients presented were motor deficits in the lower and upper limbs and changes in balance. The studies generally had similar objectives, such as improving muscular strength and fitness, ROM (range of movement), QoL (quality of life), and independence in ADLs (activities of daily living).

The intervention period, frequency, and duration. The period varied between 3 to 15 weeks, and the frequency between 2 to 5 times a week. Each session lasted approximately one hour and was divided into warm-up, active physical exercise, and rest. Some days, the patients who received the physical activities intervention were shared with other professionals such as occupational therapists (OT), speech therapists, and psychologists.

The physical activities were performed with elastic bands at various levels, Swiss exercise ball, loads, cycle ergometer, stepper, and exercise bike to improve muscle strength, walking, ROM, and activities of daily living (Chart 3).

Each study had different ways of evaluating the participants, with various scales, questionnaires, and tests, such as manual dynamometry and goniometry, FIM (Functional Independence Measure), SF-36 Questionnaire, and Romberg Test. All patients were evaluated before and after the intervention to report the patient's progression during the rehabilitation programs/protocols (Chart 4).

Chart 2. Study population

Author/Year	N	Age range	Sex
Sá et al.[8] (2015)	1	17 years	Female
Dayyer et al.[16] (2018)	4	6 - 18 years	2 Males 2 Females
Khan et al.[17] (2011)	40 (EG) 39 (CG)	> 18 years	Both sexes
Ko et al.[18] (2017)	1	35 years	Male
Kou et al.[19] (2016)	1	27 years	Female
Montini et al.[20] (2016)	1	42 years	Male
Nascimento et al.[21] (2012)	1	23 years	Female
Sendhilkumar et al.[22] (2013)	10 (EG) 10 (CG)	15 - 58 years	13 Males 7 Females

EG= Experimental Group; CG= Control Group

Chart 4. Intervention strategies

Author/Year	Physical activities performed	Period	Duration	Frequency
Sá et al.[8] (2015)	Hydrokinesiotherapy with Watsu and Bad Ragaz and underwater breathing exercises (oxygenations) were used. The intervention was divided into warm-up (5 min), stretching (20 min), general exercises, and specific exercises (30 min) with abdominal exercises, such as walking, cycling, and step exercises, and relaxation (5 min)	15 weeks	1 hour	1 X per week
Dayyer et al.[16] (2018)	Warm-up (10 min) and stretching (5 min); Specific physical exercises (20 min): Specialized as Swiss ball and elastic band resistance against gravity; Rest (10 min)	8 weeks	1 hour	3 X per week
Khan et al.[17] (2011)	EG: Individualized training program with strengthening exercises, resistance, gait training, daily function, advice, and psychological support; CG: Home program with walking, stretching exercises, and usual home activities	8 weeks	1 hour	3-5 X per week
Ko et al.[18] (2017)	Movements for basic and functional daily life (30 min); Warm-up (5 min); Resistance exercise (3 sets of 15 repetitions) for upper limbs, trunk, and lower limbs using an elastic band (30 min); Rest (5 min)	8 weeks	45 min	2 X per week
Kou et al.[19] (2016)	Balance, transfer, gait, steps, functional activity, functional circuit, therapeutic exercises, yoga, sensory exercises, and instruction for carrying out a home exercise program (stretching, strengthening, coordination, and stability)	8 weeks	45-60 min	2-3 X per week
Montini et al.[20] (2016)	Lower limb stretching, transfers, stand-in-table orthostatism and parallel bars with trough and extensor splint, postural changes, strengthening, use of a cycle ergometer for upper limbs and lower limbs, training, and guidance for eating, bathing and ADLs, robotic therapy, aerobic training on a cycle ergometer horizontal and upper limb ergometer and resistance training with elastic band and different loads, in addition to psychological support	8 weeks	>3 hours	5 X per week
Nascimento et al.[21] (2012)	Hydrokinesiotherapy with Watsu and Bad Ragaz and underwater breathing exercises (oxygenations) were used. The intervention was divided into warm-up (5 min), stretching (20 min), general exercises, and specific exercises (30 min) with abdominal exercises, such as walking, cycling, and step exercises, and relaxation (5 min)	12 weeks	1 hours	2 X per week
Sendhilkumar et al.[22] (2013)	Both groups received intervention with active and passive assisted ROM, stretching, strengthening, breathing exercises, gait training, hand function, trunk stability, and transfer techniques. The EG received yoga sessions using rapid relaxation techniques, pranayama, and guided meditation, and the CG received only conventional treatment	3 weeks	1 hours	5 X per week

EG= Experimental Group; CG= Control Group; ADS= Activities of daily living; PNF= Proprioceptive Neuromuscular Facilitation; ROM= Range of Motion

Chart 4. Outcomes evaluated

Author/Year	Outcome assessments	Main results
Sá et al.[8] (2015)	MRC; Goniometry; Romberg test; BBS	There was a significant improvement in the left lower limb, but the difference was insignificant compared to the right lower limb. In plantarflexion and dorsiflexion ROM, the right lower limb obtained 55% and 53%, respectively, and the left lower limb was 6% and 87.5%. The Romberg test demonstrated progress of 50%, as did the BBS, which evolved from 19/56 to 34/56 points
Dayyer et al.[16] (2018)	Manual dynamometry; Hand goniometry; CBCL	Ankle strength increased by about 4.2%, quadriceps strength by about 31%, and hip strength by 20.8%. ROM at the ankle increased by approximately 13%, at the knee by approximately 24.5%, and at the hip by 31.8%. Patients' QoL increased by approximately 28.57%
Khan et al.[17] (2011)	FIM; WHOQOL-bref; DASS-21; PIPP	The EG showed an improvement of 58.6% compared to the CG, which obtained 32.4%. In self-care and mobility, the EG presented 54.8% and 41.9%, respectively, whereas the CG had 5.3% and 2.6%. There was no significant change in both groups in the DASS-21 or WHOQOL-brief scores, except for the "relationship" subscale of the PIPP
Ko et al.[18] (2017)	BI; Isokinetic dynamometer	In BI, there was an improvement from 54 to 79 points. There was also improvement in shoulder flexion and extension (around 88%), knee flexion and extension (around 165%), and lumbar flexion and extension (around 41%)
Kou et al.[19] (2016)	BI; Gait; BBS; TUG; Manual muscular test; PES; NPRS; Posture	The gait speed increased from 0.4 to 1.33 m/s, and the TUG test decreased from 17 to 5.13 sec. An improvement from 84/100 to 100/100 was observed in BI and in EEB, which improved from 32/56 to 56/56. The muscle test showed a slight improvement in all the main muscle groups affected at the initial examination
Montini et al.[20] (2016)	FIM	There was an improvement in trunk control, coordination in upper limbs, and muscular resistance in isometrics. There was a decrease in postural compensations, doubling the amount of muscle strength. In the FIM assessment, there was an improvement from 50 to 68 points, indicating progress in functional Independence
Nascimento et al.[21] (2012)	SF-36; Manovacuometry; Goniometry	The SF-36 questionnaire went from 0% to 100%. Respiratory, balance, coordination, and physical conditioning training caused this significant improvement and recovery in QoL. MIP and MEP showed a positive response of +50 cm/H2O and -50 cm/H2O, respectively. An increase in ROM in flexion, extension, adduction, and abduction movements of the shoulder, hip, knee, and ankle were obtained
Sendhilkumar et al.[22] (2013)	PSQI; HAD; NPRS; IB	The EG showed a significant improvement in sleep quality compared to the CG. Regarding functional status, pain, anxiety, and depression, both groups improved. However, there were no statistically significant differences between the groups

CBCL= Child behavior checklist; FIM= Functional Independence Measure; WHOQOL-BREF= The World Health Organization Quality of Life; DASS-21= The Depression Anxiety Stress Scale-21; PIPP = The Perceived Impact of Problem Profile; BI= Barth Index; BBS= Berg Balance Scale; TUG= Timed Up and Go; PES= Perceived Exertion Scale; NPRS= Numeric Pain Rating Scale; SF-36= 36-Item Short Form Survey; MIP= Maximal Inspiratory Pressure; MEP= Maximal Expiratory Pressure; ROM= Range of motion; MRC= Medical Research Council; PSQI= Pittsburgh Sleep Quality Index; HAD= Hospital Anxiety and Depression Scale

DISCUSSION

This systematic review aimed to identify and demonstrate the benefits of physical exercise in the Rehabilitation Process for individuals diagnosed with the Syndrome. The included studies evidenced significant benefits of physical exercise in rehabilitating these patients.

The results showed that physical exercise is a suitable intervention in rehabilitation, not only in physical fitness but also mental disorders. Some studies described significant improvements after intervention regarding symptoms of depression, anxiety, and sleep quality, evaluated by objective measures and self-report.

Furthermore, the analysis revealed that positive physical exercise results can be observed in as short as three weeks, nonetheless the suggestion is that such exercises should continue after discharge. Physical exercise can be adapted to address different deficits, meeting the needs of each individual.

The lack of published studies on physical activities for patients with GBS and the samples, interventions, and assessment heterogeneity are limitations of this review. Future studies must be developed to allow for a more effective analysis of the benefits of physical exercise for patients undergoing rehabilitation for GBS sequelae. Another limitation is the rare long-term assessment.

The studies included in this review had short-term interventions, no longer than 12 weeks, 1-hour sessions 3 to 5 times a week.[22]

Therefore, these intervention protocols and assessments limited the understanding of the long-term benefits of physical exercise, demanding future studies with long-term interventions to provide a more complete comprehension of such therapies.

Although physical exercise has proven effective in the rehabilitation of GBS in the general aspects of QoL, integrated approaches combined with pharmacotherapy are needed to achieve more significant results. Future studies exploring this combination of approaches might enhance clinical practice results.

This systematic review brought significant evidence that physical exercise effectively treats the sequelae of GBS. Despite the limitations found, the results show that the arguments for implementing physical exercise into the rehabilitation programs of these patients are strong, especially for recovering QoL and Functional Independence. Nonetheless, future studies should have rigorous intervention and assessment designs and investigate the long-term effects of such treatment in combination with other therapeutic approaches to improve the progress of individuals undergoing treatment for GBS sequelae.

CONCLUSION

There are several types of effective physical exercise programs

for patients with GBS, such as improving mobility, ROM, muscle strength, cardiopulmonary function, and reducing fatigue, which is one of the most common complaints of these patients. It is necessary to start the process in the early stages of the disease and continue onwards to achieve ideal rehabilitation and avoid recurrence.

The absence of control groups in the studies reduced validity, preventing researchers from determining whether the intervention was the actual cause of the symptomatic evolution. Only two of the eight studies included in this review reported a control group, of which only one mentioned the inclusion of chronic patients. The results of this study should be interpreted with caution, given its limitations, as few high-quality studies addressed this topic of physical exercise for patients with GBS. Nonetheless, the studies included in this review showed statistically significant results, regardless of the recurrent small sample size.

Finally, even expanding the timeframe of this review to include studies from 2010 onwards, it was impossible to find sufficient studies due to the scarcity of current literature that addresses the proposed topic, limiting our findings.

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